

Bodybuilding and Myostatin

Subjects: Sport Sciences

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MSTN is a gene that makes instructions for producing the protein myostatin, a protein that is part of the transforming growth factor beta family (TGF β). The TGF β family of proteins control the growth of tissues in the body, myostatin is found nearly exclusively in the skeletal muscles where it is active before and after birth. The protein actually controls skeletal growth by restraining it, preventing muscles becoming excessively large. Current research that surrounds myostatin is based around its potential treatment in muscle wasting disorders, animals that have mutations in the encoding gene MSTN show greater muscle mass, strength and in some circumstances reduced bodyfat, which can be known as myostatin-related muscle hypertrophy.

This study aimed to see the prevalence of mutations in the male bodybuilder population (n = 92) and if having a mutation had any affect on their muscle size and/or muscle performance. The study which looked at mutation prevalence in rs1805086, arm circumference, pull-up max and push-up max.

The results show that 17% (16) of the subject group had one mutation (AG), 83% (76) had the common outcome (AA) and 0% (0) had two mutations (GG). Those with the AG outcome had an average arm circumference of 46.37cm compared with AA which had an average of 42.02cm. Those with the AG outcome had an average pull-up max score of 21 compared with AA with an average of 12. Those with the AG outcome had an average push-up max of 61 compared with AA with an average of 40.

The study clearly shows that those with a mutation are rare, however the mutation does appear to give the subject a performance and size advantage over those with the common outcome.

Keywords: genetics ; bodybuilding ; myostatin ; MSTN ; genes ; weightlifting ; sports ; fitness

1. Introduction

MSTN is a gene that makes instructions for producing the protein myostatin, a protein that is part of the transforming growth factor beta family (TGF β). The TGF β family of proteins control the growth of tissues in the body, myostatin is found nearly exclusively in the skeletal muscles where it is active before and after birth. The protein actually controls skeletal growth by restraining it, preventing muscles becoming excessively large. Current research that surrounds myostatin is based around its potential treatment in muscle wasting disorders, animals that have mutations in the encoding gene MSTN show greater muscle mass, strength and in some circumstances reduced bodyfat, which can be known as myostatin-related muscle hypertrophy. ^[1]

This is a study based on the extracted data from an anonymised data bank of genetic and individual data, it is aimed at building a basis for research on the gene MSTN and how it interacts with athletes.

2. Aim

The study aims to discover if the gene MSTN, in particular mutations in the SNP rs1805086 have any impact on the male bodybuilding population (n = 92) from a muscle hypertrophy and muscle performance standpoint.

The secondary aim is to speculate if rare mutations are more prevalent in those who decide to choose a sport such as bodybuilding, as research indicates that mutations in MSTN can illicit larger muscle mass and a reduction in bodyfat.

3. Methods

Data is taken from an anonymised genetic and individual data bank (Muhdo Health Ltd.), which gains consent for research purposes. Individuals that fall within the study criteria (M, 22-29y/o, training for bodybuilding for 3 years +), complete the following tests and record scores:

Pull-up max – As many full pull-ups (palms pronated) as possible before having to cease (let go of the bar). No straps were permitted.

Push-up max – As many push-ups within one-minute, full push-ups.

Arm circumference – Measured arm circumference when arm is flexed.

This data is added to already collected data and the genetic outcome for rs1805086.

4. Results

Table 1. Data set for study.

Individual	rs1805086 (MSTN) variant:	Pull-Up Results (60s)	Push- Up Results (60s)	Sex	Age	Weight KG	Height CMs	Arm Circumfrence CMs flexed	Sport (3 years +)
AOX1	AA	11	48	M	26	77	178	42.2	Bodybuilding
AOX2	AA	14	50	M	25	73	179	41	Bodybuilding
AOX3	AA	12	38	M	28	82	181	43	Bodybuilding
AOX4	AA	9	37	M	27	85	180	41	Bodybuilding
AOX5	AA	14	34	M	23	87	178	42	Bodybuilding
AOX6	AA	16	39	M	28	82	182	43	Bodybuilding
AOX7	AG	18	62	M	24	91	181	46	Bodybuilding
AOX8	AA	15	58	M	26	85	182	43	Bodybuilding
AOX9	AA	10	50	M	28	81	173	42	Bodybuilding
AOX10	AG	19	59	M	23	90	183	45	Bodybuilding
AOX11	AA	10	34	M	22	81	168	40	Bodybuilding
AOX12	AA	9	41	M	25	78	175	41	Bodybuilding
AOX13	AA	12	43	M	27	82	177	42	Bodybuilding
AOX14	AA	11	46	M	23	84	173	43	Bodybuilding
AOX15	AA	15	32	M	23	88	181	44	Bodybuilding
AOX16	AA	13	34	M	28	87	181	43	Bodybuilding
AOX17	AA	16	38	M	27	86	180	44	Bodybuilding

AOX18	AA	12	39	M	26	82	184	42	Bodybuilding
AOX19	AA	11	41	M	24	81	182	41	Bodybuilding
AOX20	AA	8	30	M	25	79	173	42	Bodybuilding
AOX21	AA	9	26	M	28	78	165	45	Bodybuilding
AOX22	AA	10	38	M	23	72	181	40	Bodybuilding
AOX23	AG	21	63	M	22	89	180	44	Bodybuilding
AOX24	AA	17	42	M	29	76	172	43	Bodybuilding
AOX25	AA	13	47	M	23	86	180	42	Bodybuilding
AOX26	AA	16	49	M	24	73	171	40	Bodybuilding
AOX27	AA	18	51	M	25	77	179	40	Bodybuilding
AOX28	AA	15	38	M	28	79	176	42	Bodybuilding
AOX29	AA	17	42	M	29	81	180	43	Bodybuilding
AOX30	AA	11	39	M	25	82	181	44	Bodybuilding
AOX31	AA	9	33	M	25	86	185	42	Bodybuilding
AOX32	AG	19	57	M	26	93	183	48	Bodybuilding
AOX33	AA	10	38	M	28	81	180	42	Bodybuilding
AOX34	AA	11	29	M	23	72	176	41	Bodybuilding
AOX35	AA	15	49	M	23	80	177	40	Bodybuilding
AOX36	AA	13	55	M	26	71	175	44	Bodybuilding
AOX37	AA	11	51	M	27	66	170	43	Bodybuilding
AOX38	AA	9	32	M	28	91	184	42	Bodybuilding
AOX39	AA	10	42	M	25	83	180	40	Bodybuilding
AOX40	AA	12	51	M	24	88	182	41	Bodybuilding
AOX41	AA	11	43	M	23	80	173	40	Bodybuilding

AOX42	AA	6	28	M	28	72	178	40	Bodybuilding
AOX43	AA	8	33	M	23	75	167	41	Bodybuilding
AOX44	AG	20	62	M	26	94	190	47	Bodybuilding
AOX45	AG	25	65	M	25	92	183	45	Bodybuilding
AOX46	AG	21	66	M	26	98	180	45	Bodybuilding
AOX47	AA	11	57	M	28	83	171	41	Bodybuilding
AOX48	AA	9	47	M	27	81	180	43	Bodybuilding
AOX49	AA	13	39	M	26	82	181	40	Bodybuilding
AOX50	AA	18	51	M	25	80	179	41	Bodybuilding
AOX51	AA	14	52	M	25	84	180	43	Bodybuilding
AOX52	AA	12	42	M	23	85	181	43	Bodybuilding
AOX53	AA	16	45	M	29	84	189	41	Bodybuilding
AOX54	AG	18	59	M	24	92	183	45	Bodybuilding
AOX55	AG	21	58	M	23	91	180	44	Bodybuilding
AOX56	AG	28	61	M	23	88	181	45	Bodybuilding
AOX57	AG	17	60	M	27	94	182	43	Bodybuilding
AOX58	AG	24	58	M	28	101	192	49	Bodybuilding
AOX59	AA	9	43	M	29	74	182	45	Bodybuilding
AOX60	AA	12	37	M	25	73	183	44	Bodybuilding
AOX61	AA	17	44	M	24	85	175	43	Bodybuilding
AOX62	AA	14	45	M	25	87	182	42	Bodybuilding
AOX63	AA	16	48	M	29	88	181	41	Bodybuilding
AOX64	AA	12	32	M	22	81	180	43	Bodybuilding
AOX65	AA	11	31	M	23	83	179	42	Bodybuilding

AOX66	AA	9	28	M	24	85	174	41	Bodybuilding
AOX67	AA	13	34	M	29	86	180	43	Bodybuilding
AOX68	AA	10	38	M	25	90	181	45	Bodybuilding
AOX69	AA	9	27	M	25	82	180	42	Bodybuilding
AOX70	AA	16	53	M	27	85	178	41	Bodybuilding
AOX71	AA	14	42	M	27	84	181	44	Bodybuilding
AOX72	AA	12	48	M	26	81	183	45	Bodybuilding
AOX73	AG	20	61	M	25	91	180	44	Bodybuilding
AOX74	AG	18	69	M	23	89	184	46	Bodybuilding
AOX75	AA	13	38	M	24	81	181	41	Bodybuilding
AOX76	AA	17	41	M	29	73	180	40	Bodybuilding
AOX77	AA	13	38	M	25	77	179	41	Bodybuilding
AOX78	AA	18	49	M	22	84	183	42	Bodybuilding
AOX79	AA	16	41	M	24	89	177	43	Bodybuilding
AOX80	AA	17	37	M	28	90	172	41	Bodybuilding
AOX81	AG	28	61	M	27	103	188	51	Bodybuilding
AOX82	AA	15	38	M	24	77	183	42	Bodybuilding
AOX83	AA	17	36	M	26	79	181	42	Bodybuilding
AOX84	AA	16	38	M	25	81	182	41	Bodybuilding
AOX85	AA	15	41	M	25	83	181	40	Bodybuilding
AOX86	AA	12	23	M	25	71	179	42	Bodybuilding
AOX87	AA	11	33	M	24	70	180	43	Bodybuilding
AOX88	AA	18	54	M	23	69	168	44	Bodybuilding
AOX89	AG	30	58	M	24	96	181	45	Bodybuilding

AOX90	AA	19	43	M	23	86	179	41	Bodybuilding
AOX91	AA	9	44	M	29	84	177	43	Bodybuilding
AOX92	AA	8	46	M	25	88	181	41	Bodybuilding

Population data

The population data for the group showed:

76 had the AA genotype

16 had the AG genotype

0 had the GG genotype

Pull-up max data

The Pull-up max average data showed:

21 (rounded down) Pull-ups completed in the AG group

12 (rounded down) Pull-ups completed in the AA group

Push-up max data

The Push-up max average data showed:

61 (rounded down) Push-ups completed in one minute in the AG group

40 (rounded down) Push-ups completed in one minute in the AA group

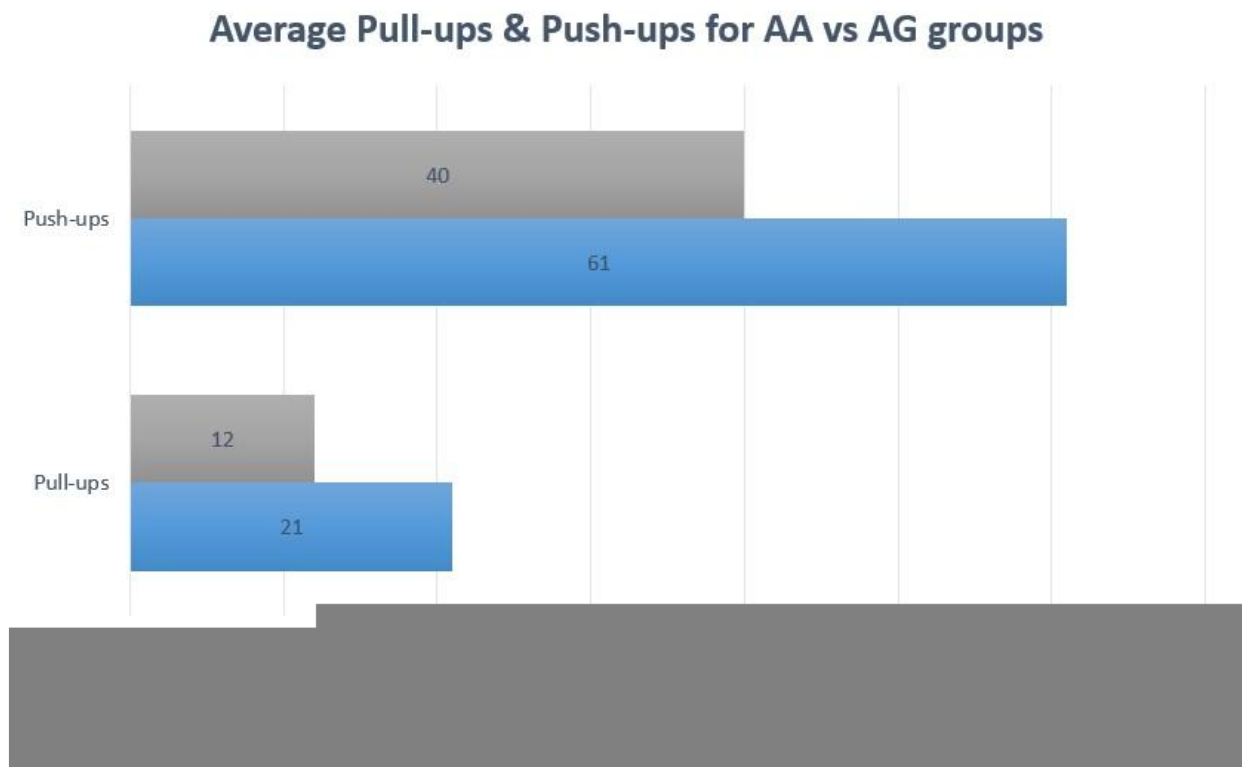


Figure 1. Average results for push-ups and pull-ups in the AA and AG group.

Arm circumference data

The arm circumference average data showed:

46.375cm arm circumference in the AG group

5. Discussion.

The primary finding in this study is that carriers of one G variant are uncommon with no participants being homozygous for GG in rs1805086. Heterozygotes had significantly increased average arm size (46.375cm in AG vs 42.028cm in AA) and improved physical test outcomes. Although more research is required and that physical ability is likely polygenic, MSTN is a good candidate gene to be analysed in any polygenic physical attribute analysis. We analysed physical strength stamina through two common tests the pull-up and push-up tests, both common exercises utilised in bodybuilding programmes^{[2][3]}. Bodybuilding requires hypertrophy of muscle tissue, this involves the increase of muscle size through either increasing myofibril size or/and sarcoplasmic storage (mainly glycogen and myoglobin) ^{[4][5]}. The most effective approach to building muscle remains a hotly debated topic, however it is considered that resistance training with adequate protein intake is the most applicable method ^[6]. As myostatin helps control muscle growth and the level of MSTN is altered by the MSTN gene those born with certain mutations can be expected to have increased strength and muscle mass, in 2004 a German boy was diagnosed with a mutation in both copies of the MSTN gene which we failed to replicate in this study, however this mutation gave him significantly stronger muscles than his peers ^[7]. Due to the potential of myostatin inhibition causing greater athletic ability, muscle hyperplasia and hypertrophy there is worry that drugs that can alter the MSTN gene or affect myostatin levels will be abused by athletes, hence they are banned by the World Anti-Doping Agency (WADA)^[8].

6. Conclusion and Follow-Up

This look into specific collated data has shown that the mutations in the gene MSTN may illicit advantages for those in bodybuilding and sports in general due to an increased muscle performance and apparent muscle size. A deeper look into a greater number of subjects will offer a greater insight into how much impact this one gene may play in sports and the general populous.

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